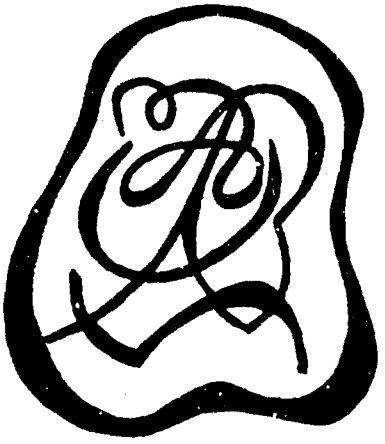

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Managing for Effectiveness in Research Organizations

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ABSTRACT

Managers apply implicitly held models of organizational effectiveness in the evaluation of subordinate organization units. Twenty-four variables have been identified as applicable in these models. Study of managers of research and development units has identified a model of organizational effectiveness underlying their evaluations of subordinate units. This model is compared with a related model identified in studies of managers in more general business settings, and several interesting differences are observed. The research and development managers place more emphasis upon staff and organizational capacity and less emphasis upon productivity than do the general business managers. These differences probably underlie much of the misunderstanding between general business managers and research and development managers. It is argued that these differences tend to reflect differences in the technology and production cycle of the two settings rather than personal differences in the groups of managers.

Managing for Effectiveness in Research Organizations

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Assessments of effectiveness of subordinate organization units are made in all business organizations, implicitly if not explicitly. Such assessments are inputs for budget making, resource allocation, personnel assignment and promotion, organizational design. Assessments usually are made with some ultimate value or goal in mind -- an ultimate criterion. An implicit ultimate criterion in all assessment is the nebulous concept of "contribution to organizational goals", usually long run profit for business organizations. Contribution to long run profit is difficult to assess in the short term, and less ultimate, mid-range criteria are utilized for short run organizational assessment. The mid-range criteria used by a manager in assessments of the effectiveness of subordinate organization units presumably measure achievement of short term goals sought either as ends in themselves or as means to long term goal achievement. The means-end relationships between variables perceived as short and long run criteria constitute at least

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an implicit model of organizational effectiveness held by the assessing manager. The mid-range criteria he applies in assessment obtain their relevance from this implicit model.

The criteria for assessment of research and development functions in business organizations are less directly derivable from the implicit means-end model. Relationships between research and development operations and long run profit are particularly difficult to establish in the short run. Furthermore, each function in the organization expects something slightly different from research and development. The sales manager, the production manager, and the controller would each apply somewhat different criteria in assessing the effectiveness of research and development organizations. The frequently discussed problems of managing research and development relate in part to difficulties in establishing short range criteria or goals for research and development functions which, if accomplished, will contribute to long run goal achievement.

Results of studies at the Industrial Relations Center aid in understanding of certain obstacles encountered in managing research and development. These results point up dissimilarities in models of organizational effectiveness applied by managers of research and development and managers of other business functions. Discrepancies between these models can help explain the seeming conflict between managers and apparent divergence in goals sought. (Mahoney, 1967; Mahoney and Weitzel, 1969).

These studies began with an investigation of the criteria applied in practice by managers in the assessment of subordinate units. Over 200 potential criteria, both short and long run measures, were identified

in managerial literature and in statements of company practice. This list was reduced rationally to 114 criterion statements through elimination of duplication and overlap. Analysis of intercorrelations of these potential criteria permitted further simplication. Descriptions of 283 subordinate organizations in terms of the 114 potential criterion variables were obtained from 83 second-level and higher-level managers in business organizations. Factor analysis of these descriptions indicated that a factor structure of 24 dimensions could account 65 percent of the variation in the descriptions of the 283 organization units. (See Table 1) All but one of the dimensions were conceptually as well as statistically independent and simple. The single complex dimension

(Insert Table 1 About Here)

incorporated the concepts of productivity, mutual support between supervisors and subordinates, and utilization of personnel.

The utility of these 24 dimensions of organizational effectiveness in the assessment of subordinate organizations was investigated using data collected from two sources: (1) the general business sample mentioned above and (2) a sample of managers of research and development units in business organizations. Each participating manager supervised three or more subordinate organization units. He described each subordinate unit using each of the 114 criteria. These criterion measures were combined into 24 dimension measures (See Table 1)) for each organization unit.

Additionally, each manager evaluated the overall effectiveness of each of his subordinate units. A stepwise linear (multiple) regression

analysis was used to generate models predictive of the overall effectiveness ratings. Two models were generated - one for the general business sample and one for the research and development sample. The regression models plus cluster analysis of the criterion dimensions provided the basis for the models of organizational effectiveness implicit in the managerial judgments and ratings.

General business sample. Eighty-three managers employed in 13 different companies provided information about 283 subordinate organization units. Industries represented in the sample were heavy manufacturing, electronics, insurance, wholesale trade, and agricultural processing. The companies ranged in size from 175 to over 10,000 employees. The participating managers held positions ranging from second-level supervisor through vice-president. The 283 organization units varied in size from 4 to more than 1,000 employees, and were engaged in all business functions - production, administrative services, finance, accounting, engineering, research, and sales.

Research and development sample. The research and development sample was relatively homogeneous. One hundred and three organization units were described and evaluated by 32 managers employed in four companies. All four companies compete directly within the same industry. The research and development function is important in development of new products and substitutes for competitor products. The importance of research and development institutes in some companies and vice-presidential appointments for research and development in all of the companies. The research and development organizations tend to be relatively "flat" with only three or four levels of supervision. The majority of the units

described were engaged in direct research with the remainder engaged in direct research support activities.

Results of the analysis within the two samples are presented separately. The analysis began in each sample with specification of a regression model utilizing all 24 criterion dimensions. The predictive model subsequently was modified by dropping insignificant criterion dimensions, and a simplified model, almost as predictive as the total model, was developed for each sample. A conceptual model of relationships among the criterion dimensions then is hypothesized for each sample based upon examination of the matrix of correlations among criterion dimensions and analysis of the correlation clusters.

General business model. The 24 dimension regression model accounted for 58 percent of variance in the judgments of overall effectiveness ($R = .76$). Regression weights for this model are presented in Table 1. A simplified four dimension model accounts for almost 58 percent of the variance ($R = .74$) in judgments of overall effectiveness (see Table 2 for regression weights). Managers in this sample tend to utilize

(Insert Table 2 About Here)

only four dimensions in differentiating among subordinate units in terms of organizational effectiveness. These dimensions are Productivity-Support-Utilization, Planning, Reliability and Initiation. One of these dimensions, the complex dimension of Productivity-Support-Utilization, accounts for most of the variance in effectiveness judgments, 29 percent.

Examination of the correlation matrix suggests a more complex model of organizational effectiveness. This model is outlined in Figure 1.

(Insert Figure 1 About Here)

The relationships indicated in the diagram reflect relationships identified empirically. Productivity-Support-Utilization, Planning, Reliability and Initiation are most predictive of overall effectiveness. The additional dimensions are correlated with overall effectiveness, but they are not independently predictive of effectiveness.

Productivity is the primary criterion of organizational effectiveness. This productive performance is accomplished in part through a high degree of manpower utilization achieved from challenging job assignments, as well as through manpower development efforts. Supportive relationships within the unit also contribute to productive performance and appear to be a function of cohesion obtained within the work force and the supervisory support provided the work force.

The planning criterion concerns the degree to which the organization is able to cope with emergencies and to concentrate efforts upon production goals. Other dimensions which relate to planning and are less uniquely predictive of effectiveness are flexibility in adapting to change, degree of cooperation with other units, and supervisory control of activities and operations within the unit.

The extent of initiation of new ideas and practices, and the degree of reliability in meeting objectives without necessity of follow-up also are independent criteria of organizational effectiveness. The two dimensions of organizational behavior appear to be independently predictive of effectiveness; other dimensions of organizational behavior are cast as predictors of the planning and productivity criteria. These other dimensions appear in the role of criteria of organizational capability for future output performance, whereas initiation and reliability contribute directly to current effectiveness.

In general, the business manager views organizational effectiveness in terms of productive efficiency and its correlates. He values an organization which copes with emergencies and changes in plans, initiates new methods, and is able to come through without checking or follow-up. Assessment of productivity in the short run is supplemented by dimensions which take on the role of criteria of organizational capability for future effective performance. The manager looks to manpower utilization, staff development, cooperative relationships, and mutual support within the unit as indicators of potential performance.

Research and development model. A linear regression model utilizing 24 criterion dimensions was generated for research and development managers using the same methodology as used for general business managers. The general model accounted for 63 percent of the variance in judgments of overall effectiveness (R = .79) which is little different from the result obtained for the general business sample (R = .76 or 58 percent of criterion variance). Regression coefficients obtained for the research and development sample are presented in Table 1 for comparison with the earlier results. This general model was reduced to a three-variable model with little loss in predictiveness, R = .71 as compared with R = .76. The three variable model (see Table 3) predicts effectiveness

(Insert Table 3 About Here)

judgments from the criteria of Reliability, Cooperation, and Development Only one of these dimensions, Reliability, appeared in the reduced model for the general business sample.

The The general explanatory model developed for judgments of organizational effectiveness in the research and development sample is presented in Figure 2. This model reflects relationships among the 24 criterion

(Insert Figure 2 About Here)

measures investigated in the study, and can be compared with the explanatory model for the general business sample.

Reliability is the primary criterion of organizational effectiveness in research and development. Productivity and planning, which were important in the general business model, are closely related to reliability of performance, but apparently account for little unique variance in judgments of effectiveness. Mutually supportive relationships within the unit again are predictive of productive performance, and appear to be a function of the cohesion of the workforce and supervisory support. Supervisory control also appears to contribute to productive performance.

Cooperation with related organization units is a second criterion. Cooperation is achieved through coordination of schedules, and flexibility in changing and adjusting assignments as required.

Development of staff members of the organization appears as the third important criterion of effectiveness. This dimension is independently predictive of effectiveness judgments in this sample rather than merely correlated with performance as in the general business sample.

Discussion

These two models of organizational effectiveness are consonant in certain respects and almost contradictory in other respects. Both samples of managers tend to rely upon relatively few criterion dimensions in making judgments of effectiveness. A few dimensions are viewed as critical, and others are perceived as predictive of these critical dimensions. Also, approximately the same proportion of variance in judgments is explained in both samples, about 50 percent, using a model of three to four dimensions. The relative importance of different dimensions for the judgment of effectiveness appears to differ between the two samples of

managers. Table 4 presents the six most predictive dimensions from each analysis and the relative importance of the dimension in the other

(Insert Table 4 About Here)

analysis. Only one dimension, reliability, appears in the top six dimensions of both samples. Criterion dimensions relating to output and productivity appear to be most important in the general business sample, and these dimensions appear to be subordinated to criteria relating to behavioral characteristics of the organization units in the research and development sample.

The criterion dimension reliability, which appears critical in both samples, probably reflects repeated short term accomplishments over a long period of time. While both groups of managers appear to value reliability, they perceive different relationships between it and productivity. Business managers assess reliability and productivity independently, while research and development managers subordinate productivity to reliability. Interestingly, both groups of managers perceive cohesion and support within the work unit to be predictive of productive performance.

Differences between the two models of organizational effectiveness are consistent with common perceptions about research and development management and management of other business functions. At first glance, these findings provide evidence to supoort the business manager who complains that research and development has no concern for marketable, productive performance. A more careful examination of the differences between

the two models suggests other reasons for the differences, differences which should be kept in mind in the management of research and development functions.

Organizational effectiveness is a difficult concept to apply in practice. All managers tend to think of some sort of long run achievement of organizational goals when they consider effectiveness. This achievement is difficult to measure in the short run, however, and managers tend to develop models of effectiveness which specify short-run or mid-range criteria which are easier to apply and which can be justified on the basis of some relationship to the ultimate criterion. These mid-range criteria can be justified as short-run prerequisites to long-run achievement, or as relevant independent criteria. Our models of organizational effectiveness demonstrate differences in relevant mid-range criteria, not differences in the ultimate criterion of effectiveness.

There are at least two possible reasons for differences in perceptions of relevant mid-range criteria of organizational effectiveness. The first, and most common, explanation is cast in terms of the different stereotypes of people involved, the business manager and the researcher. The second, and we believe more persuasuve, explanation is cast in terms of the production cycles in the two situations.

Research and development personnel in many industries are stereotyped as professionals, individuals who are primarily concerned with standards of performance independent of the product market. Business managers, on the other hand, are viewed as primarily responsive to the test of the marketplace. Thus, the research and development manager would assess organizational effectiveness in terms of professional competence of his

staff, their day to day activities, and would be relatively unresponsive to considerations of productivity and efficiency. This opposition between professional and economic orientations is reinforced by the establishment of dual promotion ladders to reward equally persons with different value orientations and by the often discussed conflict between research and development performance and business management.

An alternative explanation takes into account the differences of production cycle in research and development and other business functions as well as other technological differences. Production cycles are relatively standardized and predictable in most business operations, e.g. production, sales, billing, finance, and administrative services. This is not the case in research and development. A research project may be continued for a significant period of time before completion or termination. Further, marketable achievements in research and development are relatively unpredictable. Marketable outputs may result from a lengthy endeavor or from a lucky coincidence of discoveries from activities conducted outside the firm. Thus it is far more difficult to estimate ultimate market impact of current research and development activities than from more traditional, routinized business operations. It is not surprising then to observe that research and development managers are more likely to judge organizational effectiveness in terms of staff competence than in terms of observably productive performance.

Thompson makes the above argument in terms of knowledge of the cause-effect relationships existing within the production process of the unit (Thompson, 1967). Evaluation in terms of productive efficiency is possible where knowledge of cause-effect relationships is relatively

complete. Productive efficiency in the short run is far less predictive of effectiveness when cause-effect relationships are unknown. This appears to be a relevant distinction between the research and development function and other business functions. A similar hypothesis is supported by findings of Joan Woodward in her studies of managerial style and production process; the more standardized the production process, the more likely the management style was to emphasize traditional efficiency criteria of assessment. (Woodward, 1965).

These studies of managerial criteria of organizational effectiveness relate to managerial style. The criteria applied by a manager in the evaluation of subordinate units reflect his model of organizational behavior and performance. He judges most critically those elements which he perceives most important in achieving long run goals. Note that this concept of style is not the same as concepts which focus upon method of communicating, decision making and handling interpersonal relationships. Rather, this concept of style relates to the priorities the manager assigns to different elements of organizational behavior performance.

Findings of these studies point up differences in managerial style found in the management of research and development functions in industry and in the management of more traditional business functions. These differences probably are due more to differences in the technology of the functions than to differences in personal orientations of the individuals concerned. One would anticipate that attempts to impose traditional criteria of short run profitability upon research and development organizations would lead to frustration of all concerned and might jeopardize the long run contribution of the research and development organization. admittedly, the management of research is difficult. Findings of these studies

suggest that the model for management of research and development is likely to be significantly different from the appropriate model for management of more traditional business functions. Further study of the appropriateness of different models for management of research and development would probably be more productive than attempts to indoctrinate research managers in the models and practices of traditional management.

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TABLE 1

Dimensions of Organizational Effectiveness
With Standardized Regression Coefficients

Dimension	Description	Gen. Bus.	R & D
Flexibility	Willingly tries out new ideas and suggestions, ready to tackle unusual problems.	.07	-.19
Development	Personnel participate in training and development activities; high level of personnel competence and skill.	.08	.23
Cohesion	Lack of complaints and grievances, conflict among cliques with the organization.	.07	.00
Democratic Supervision	Subordinates participate in work decisions.	.03	.01
Reliability	Meets objectives without necessity of follow-up and checking.	.13	.27
Selectivity	Does not accept marginal employees rejected by other organizations.	.02	-.16
Diversity	Wide range of job responsibilities and personnel abilities within the organization.	-.02	-.03
Delegation	High degree of delegation by supervisors.	.04	-.09
Bargaining	Rarely bargains with other organizations for favor and cooperation.	-.05	.01
Emphasis on Results	Results, output, and performance emphasized, not procedures.	.01	.14
Staffing	Personnel flexibility among assignments; development for promotion from within the organization.	.06	.01
Coordination	Coordinates and schedules activities with other organizations, utilizes staff assistance.	-.08	-.08
Decentralization	Work and procedural decisions delegated to lowest levels.	-.01	.19
Understanding	Organization philosophy, policy, directives understood and accepted by all.	-.08	-.04

TABLE 1 (Con't)

Dimension	Description	Gen. Bus.	R & D
Conflict	Little conflict with other organization units about authority of failure to meet responsibility.	-.09	-.01
Personnel Planning	Performance not disrupted by personnel absences, turnover, lost time.	-.04	-.06
Supervisory Support	Supervisors support their subordinates.	-.12	-.04
Planning	Operations planned and scheduled to avoid lost time; little time spent on minor crises.	.25	.31
Cooperation	Operations scheduled and coordinated with other organizations; rarely fails to meet responsibilities.	.11	.33
Productivity-Support-Utilization	Efficient performance; mutual support and respect of supervisors and subordinates; utilization of personnel skills and abilities.	.43	.12
Communication	Free flow of work information and communications within the organization.	-.07	-.27
Turnover	Little turnover from inability to do the job.	.01	.17
Initiation	Initiates improvements in work methods and operations	.09	.12
Supervisory Control	Supervisors in control of progress of work.	.03	.08
Multiple Correlation, R		.76	.79

TABLE 2

Standardized Regression Coefficients
For Four Dimension General Business Model

Dimension	Weight
Productivity-Support-Utilization	.42
Planning	.22
Reliability	.16
Initiative	.12

R = .74

TABLE 3

Standardized Regression Coefficients
For Three Dimension Research and Development Model

Dimension	Weight
Reliability	.43
Cooperation	.27
Development	.19

R = .71

TABLE 4

Ranked Importance of
Criteria of Organizational Effectiveness

General Business Rank	Dimension	Research and Development Rank
1	Productivity-Support-Utilization	14
2.	Planning	10
3	Reliability	1
4	Initiation	13
5	Bargaining	20
6	Supervisory Support	17
3	Reliability	1
12	Cooperation	2
10	DevelopmentD	3
22	Turnover	4
15	Selectivity	5
14	Flexibility	6

FIGURE 1

General Business Model of Organizational Effectiveness

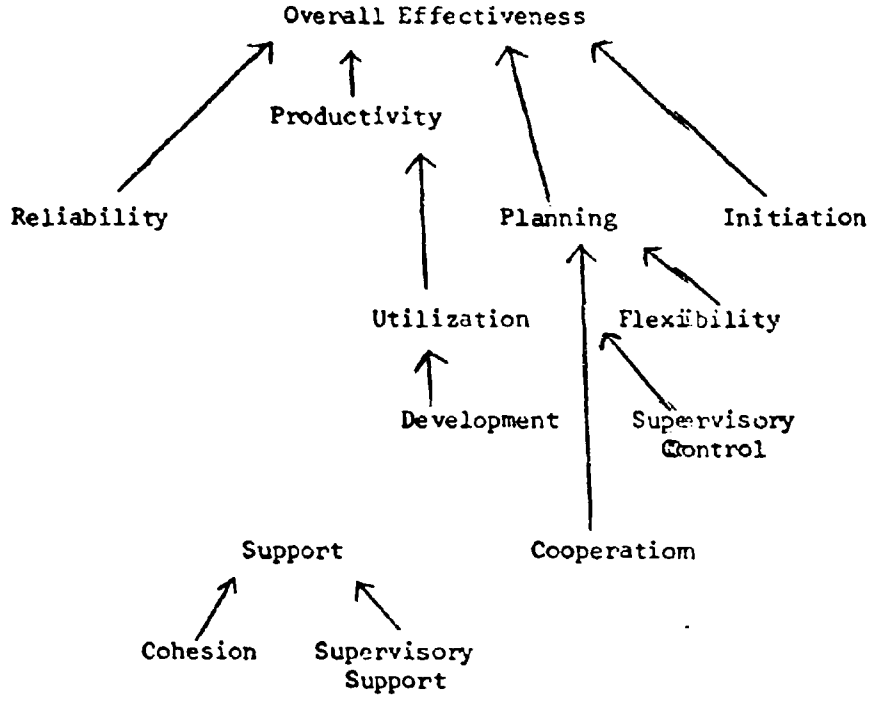

FIGURE 2

Research and Development Model of Organizational Effectiveness